

Climatic controls on continental erosion and sediment transport

Conveners

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Sponsors

GSA foundation, International Association of Sedimentologists

Description and Objectives:

The physical and chemical breakdown of continental crust into sediments by solid Earth tectonic and climatically modulated forces are key steps in many global geochemical cycles. These processes control the compositional evolution of the continental crust, and ultimately the recycling of material back into the upper mantle via subduction zones. The products of erosion and weathering are supplied to sedimentary basins within continents and to continental margins where they may be preserved, allowing reconstruction of tectonic and environmental histories of adjacent landmasses through the application of suitable proxies. Although tectonic forces are known to be a strong primary control on the generation of sediment, this meeting focuses on assessing the dynamic role of global and regional climate in controlling the production, transport, and deposition of sediments to basins over millennial to million-year timescales. How does climate mediate the sedimentary record and under what conditions can paleoenvironmental and paleoclimatic change be unambiguously deconvolved from the erosional signals preserved in the rock record?

There is no doubt that accelerated rock uplift can drive faster erosion rates of bedrock source terrains. What remains less clear, however, is how erosion and transport efficiency can be governed by climatic and earth surface processes independent of tectonics, especially when changes in these processes often occur as a consequence of tectonic forcing. Although it has typically been argued that stronger precipitation results in faster bedrock erosion, this relationship can be much more complex in many systems. This is because the simple model ignores factors such as seasonality and intensity/duration of precipitation, degree of soil and vegetation development, and/or topographic steepness among many others. Often, understanding of several critical processes, their relative rates, and distributions is required to define any relationship between climatic change and sediments produced as a result from that change. Yet, many equations for fundamental relationships in sediment transport and erosion still remain in the earliest stages of development. Furthermore, whether the same rules and conditions observed between climate, erosion, and sediment transport can be applied across different time scales is a source of considerable contemporary debate.

We solicit talks that aid in understanding how climate can drive erosion and exhumation of source terranes, as well as the earth surface processes that transport and deposit sediments in basins. Global Cenozoic climate, fluctuating sea level, and large-scale glaciation have pivotally affected our planet, from the physical evolution of mountain belts to the chemical breakdown of sediments distributed across margins. How do longer- and shorter-term climatic phenomena dictate rates of sediment supply and records of provenance? Sediments are rarely transferred immediately from bedrock to the deep sea because of intermittent storage and release. To what extent and over what timescales do environmental conditions mediate the periodic storage and transport of

sediments between sources and final depocenters? Climatic control over sediment transport certainly extends to the offshore, so how do earth surface processes dictate the supply, loading, and stratigraphic architecture along margins and into the deep sea? When, where, how is it possible to isolate the erosional signals produced by tectonic forcing from those linked to climatic processes? And, under what conditions and timescales can precise and accurate climatic records be reconstructed from sediments?

This conference seeks to discuss these challenging questions. We particularly solicit contributions addressing erosion and/or environmental change from all earth surface process disciplines that permit robust correlation between changes in climate, erosion, and sediment transport. Separating drivers and processes continues to be difficult but are much improved in recent years as field studies are coupled with novel spatial and temporal control and further tested with dynamic landscape and stratigraphic models. This transdisciplinary meeting is intended bring together sedimentologists, geomorphologists, landscape and stratigraphic modellers, as well as paleoclimatologists to showcase the current state of research, demonstrate contemporary evidence and methods from studies worldwide, and underline the research concerns remaining in our community.

A preliminary outline of thematic sessions is:

1. From source to sink: tracing erosional signals
2. Beyond the mainstream: continental deposition and erosion outside fluvial systems
3. Cycles, thresholds, and feedbacks: the evolving atmosphere and biosphere
4. From ice to the ocean
5. Closing the gap: emergent tools and techniques for integrating earth surface process and solid earth datasets across different timescales
6. Moving forward: innovations in data sharing, visualization, and modelling to understand landscapes and climate
7. History matters: Reconciling tectonic, climate, and erosion histories



Caption: Fireweed meadow with Mendenhall Glacier and the Towers
Photo credit: Gillfoto (Kenneth J. Gill)

Preliminary Agenda

This seven-day meeting will start with an icebreaker in the evening of Sunday, 4 August 2019 in the city of Juneau, nestled within the Coast Mountains of southeast Alaska. It will end in fjordland, at the feet of Tracy Arm tidewater glaciers on the afternoon of Saturday, 10 August 2019. The meeting will balance between invited talks, roundtable discussions, pop-ups, and poster presentations, with the first field trip occurring mid-week.

The mid-week field trip is structured to travel from the glaciated Coast Mountains to fjordal marine sinks and, in doing so, touch upon some of the dominant erosional and transport processes discussed during the meeting. This region of southeast Alaska is similar in setting to the beautiful Glacier Bay National Park to the west. Set within the Coast Mountains, Juneau features the Juneau Ice Field (including Mendenhall and Taku glaciers), abundant fjordland landscapes, uplifted glaciomarine sediments, some of the fastest ongoing glacial isostatic adjustment (~3 cm/yr), fault-controlled fluvial morphology, and a rich history of gold mining and salmon fishing. The last-day field trip by high-speed catamaran in Tracy Arm would involve a casual geologic tour through the structure and evolution of the Coastal Shear Zone. Along the way, notable views around some of the deepest fjordland in North America will incite discussion about fjord formation and sedimentation dynamics. Tours to Tracy Arm typically culminate in front-row seats to the Twin Sawyer glaciers to observe ice-calving and iceberg formation.

All nights will be spent at the Westmark Baranof Hotel, which is a 15-minute drive from the Juneau International Airport (JNU). Juneau is only a few hours flight from several large, international aviation hubs (Seattle/Tacoma, Vancouver, Anchorage).



Caption: Tracy Arm
Photo credit: Peter Mulligan

Attendees and Estimate Costs

Registration fee is estimated at US\$950-\$1050 and will cover the cost of the meeting, hotel lodging for six nights (double occupancy; single occupancy may be possible with additional fees), icebreaker reception, all lunches, coffee breaks, and poster refreshments, the mid-meeting conference dinner, and transportation and meals for the first field trip. The second field trip is optional; this cost is not included in registration and will be determined at a later date based on number of interested participants. Airfare is not included and participants must make their own travel arrangements.

Applications and Registration

Application period opens: 1 March 2019
Application Deadline: 1 May 2019
Registration Deadline: 7 June 2019

The conference will be limited to 70 participants and each participant will have to commit to attending the first full six days of the conference, with an option to attend the last-day field trip. To apply, please put together

- (1) A brief statement of your interests and the relevance of your recent work to the conference themes (max. 300 words);
- (2) the tentative title of your proposed presentation;
- (3) an NSF-style (or similar format) curriculum vitae; and
- (4) your contact information.

Submit your application to the conveners at t.jonell@uq.edu.au with "CLAST2019_Lastname.Firstname" as the Subject title. Interested graduate students, underrepresented researchers, and early career faculty are especially encouraged to apply. Once you have been selected to participate, you will be sent registration information.

For more information please visit the conference website [<https://clast2019.weebly.com/>]



Caption: Nelchina River and Glacier
Photo credit: Peter D. Clift